

## **RECENT DEVELOPMENTS AT THE CDDIS**

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### **Abstract**

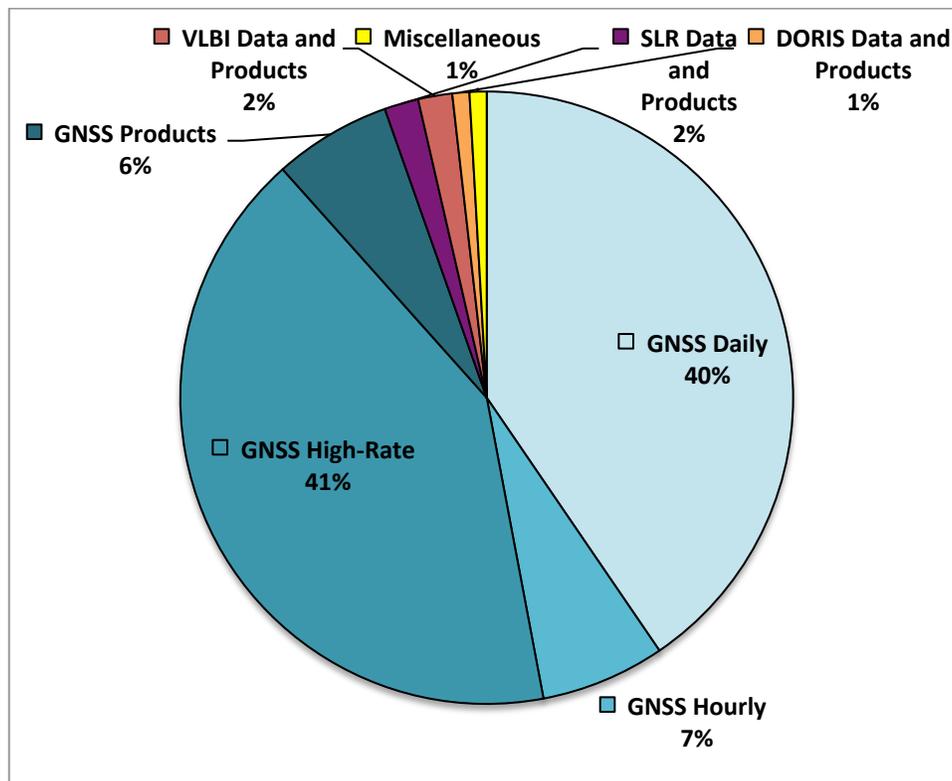
The Crustal Dynamics Data Information System (CDDIS) supports data archiving and distribution activities for the space geodesy and geodynamics community. The main objectives of the system are to store space geodesy and geodynamics related data products in a central data bank, to maintain information about the archival of these data, and to disseminate these data and information in a timely manner to a global scientific research community. The archive consists of Global Navigation Satellite System (GNSS), laser ranging, Very Long Baseline Interferometry (VLBI), and Doppler Orbitography by Radiopositioning Integrated on Satellite (DORIS) data sets and products derived from these data. The CDDIS is one of NASA's Earth Observing System Data and Information System (EOSDIS) distributed data centers; EOSDIS data centers serve a diverse user community and are tasked to provide facilities to search and access science data and products. The CDDIS data system and its archive is a key component in several of the operational services within the International Association of Geodesy (IAG) and its project the Global Geodetic Observing System (GGOS), including the IGS, the International DORIS Service (IDS), the International Laser Ranging Service (ILRS), the International VLBI Service for Geodesy and Astrometry (IVS), and the International Earth Rotation and Reference Systems Service (IERS). Several activities are nearing completion at the CDDIS to aid users in data discovery, both within the international space geodesy community and beyond. This poster and associated paper will include background information about the system and its user communities, archive contents and updates, enhancements for data discovery, new system architecture, and future plans.

### **Introduction**

The Crustal Dynamics Data Information System (CDDIS) is NASA's active archive of space geodesy data, products, and information (GNSS, laser ranging, VLBI, and DORIS). The CDDIS is one of twelve NASA Earth Observation System Data Information System (EOSDIS) Distributed Active Archive Centers (DAACs). The largest CDDIS user community comes from the services within the International Association of Geodesy (IAG). The CDDIS serves as one of the primary data centers and core components for the geometric services established under the IAG, an organization that promotes scientific cooperation and research in geodesy on a global scale.

In 2013, the CDDIS became a regular member of the International Council for Science (ICSU) World Data System (WDS), an international organization that strives to enable open and long-term access to multidisciplinary scientific data, data services, products and information.

The CDDIS archive is over eleven Tbytes in size with nearly 150 million files. Over ten Tbytes of this archive, or about 95%, is devoted to the storage of GNSS data and derived products. Suppliers of content for the archive transfer files to an incoming disk location. Incoming data are quality-checked, summarized when required, and, within minutes of receipt, archived to public disk areas in subdirectories by data type and other parameters (temporal, target, etc.). Figure 1 shows the allocation of the CDDIS archive by data type. The CDDIS archive consists of mainly global station data and products derived from these data, as well as information and metadata describing the archived data and products. The archive consists of multi-day, daily, hourly, sub-hourly files with varying submission latencies (minutes, hours, days).



*Figure 1. Allocation of space in the CDDIS archive by data set. The majority (nearly 95%) of the CDDIS archive is devoted to GNSS data and derived products.*

In the last year, the CDDIS received (or retrieved) approximately 250 Gbytes (nearly 2.25M files) of data and derived products during a typical month of file ingest operations, which totaled approximately 2.8 Tbytes (over 22.6M files) of new information for the online archive. This yearly ingest rate increases with time as new projects are undertaken, new stations are added to the networks, and new products are developed by the services.

During the last year, the CDDIS distributed over ninety Tbytes of data and derived products from approximately 570 million files. Figure 2 illustrates the monthly distribution statistics during this timeframe.

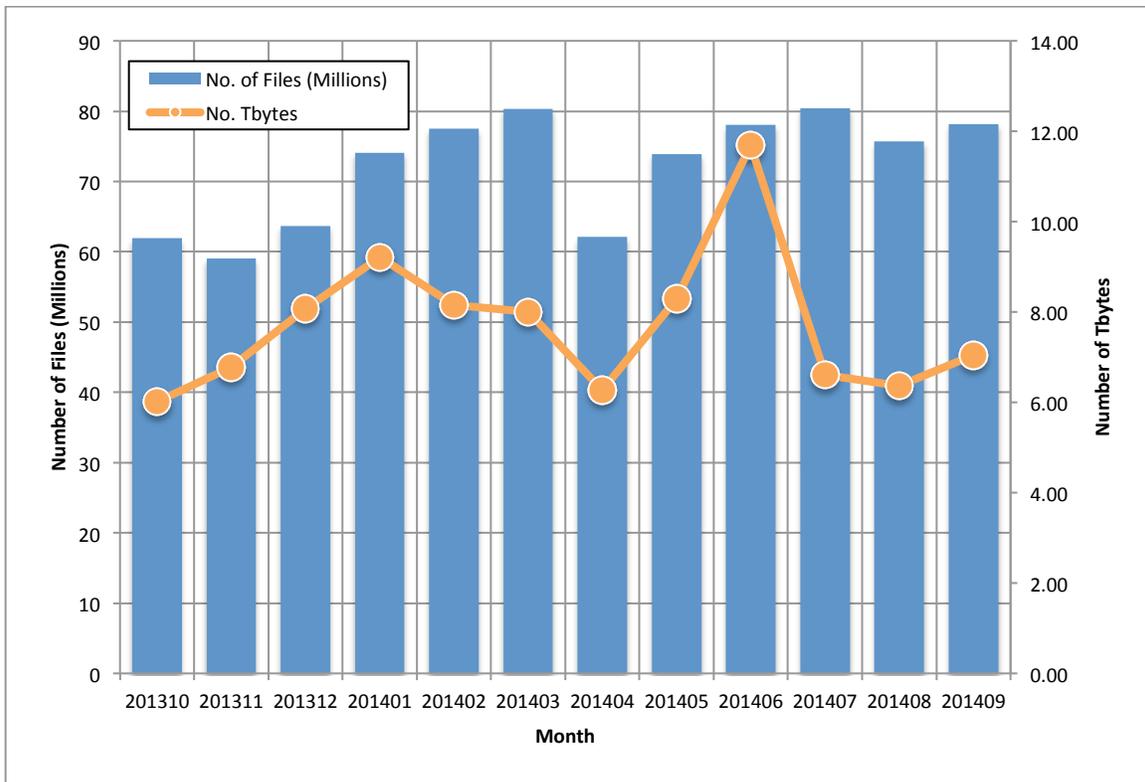


Figure 2. The amount of data and derived products distributed by the CDDIS on a monthly basis for the last year.

## Recent Developments

### *Real-Time Activities*

In support of the IGS Real-Time Service (RTS), the CDDIS has installed a real-time streaming capability. The CDDIS uses the closed source server software called Networked Transport of RTCM via Internet Protocol (NTRIP) from the German Agency for Cartography and Geodesy (BKG) as the foundation for establishing a real-time “caster” at the CDDIS using a dedicated server. The caster allows for receiving and serving real-time GNSS data and product streams. Because user registration is required within the IGS RTS, staff developed a software module to plug in to the EOSDIS User Registration System (URS); this module handles user registration to receive data streams and enables the NTRIP code to be compliant with NASA required regulations for user registration of web services. The real-time process is shown in Figure 3.

The real-time caster disseminates differential correction data or other kinds of GNSS streaming data to stationary or mobile users over the Internet. Mobile users obtain corrections/data from reference stations in real-time to improve positioning. The real-time data and products available through the caster include: data streams from a global network of high-quality GNSS receivers, GNSS satellite orbits, satellite clock solutions, and ionosphere information. These products enable real-time precise point positioning at global scales used in scientific research and hazard detection applications. The CDDIS staff has also begun developing code and an operations process for capturing incoming data streams for generation and comparison of high-rate data files. Test-

ing continues on the CDDIS caster operation and the user registration process; the real-time infrastructure at the CDDIS will be operational in early 2015.

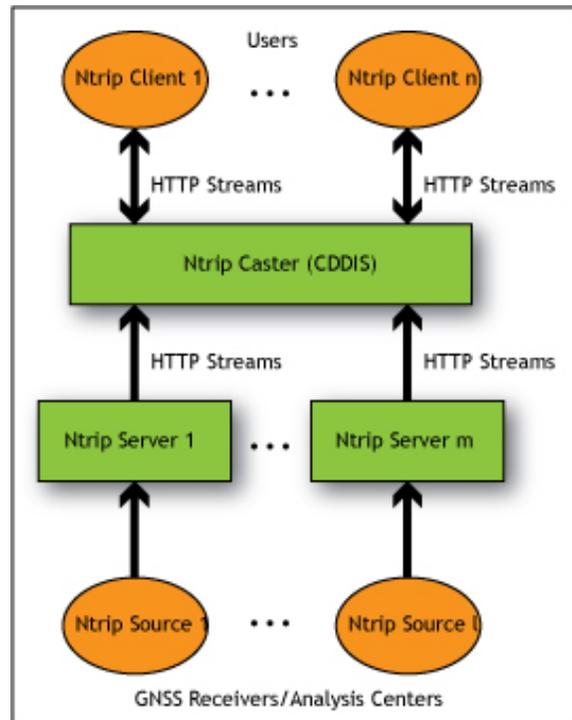


Figure 3. Concept for NTRIP real-time data transmission.

### **Website Improvements**

With the assistance of the EOSDIS website team, the CDDIS staff completed a re-design of its website in 2013. Content were reviewed, updated, and transferred to a new webpage and navigation design. The revised CDDIS website became operational in March 2014. The new website includes an improved navigation design, search interface, and a fully functional Site Log Viewer application and map selection tool. The homepage of the new CDDIS website is shown in Figure 4a. Through the Site Log Viewer application, users can display a complete IGS, ILRS, or IDS site log, section by section, display contents of one section for all site logs, and search the contents of one section of a site log for a specified parameter value. Thus, users can survey the entire collection of site logs for systems having particular equipment or characteristics. The map selection tool on the homepage allows users to view locations of sites, globally or by region, whose data are found in the CDDIS archive.

In addition, the CDDIS archive is now accessible through http as well as ftp. This new archive access method provides flexibility for the user community. The main page for the archive access through http is shown in Figure 4b.



Figure 4a. Home page of the redesigned CDDIS website (<http://cddis.nasa.gov>).

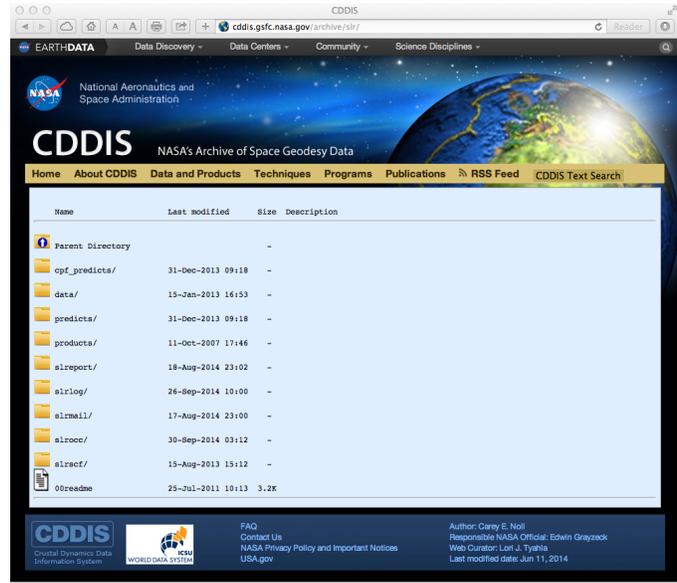


Figure 4b. CDDIS archive access through the http web interface.

## Future Developments

### System Upgrades

Funding was identified in 2013 to procure a computer system refresh for the CDDIS. Hardware was procured in mid-2014 with installation beginning in late 2014 and scheduled for completion and testing in early 2015. The system will be installed within a new computer facility at GSFC that will provide a more reliable/redundant environment and network connectivity; a disaster recovery system will be installed in a different location on the GSFC campus. The new system location will address the number one operational issue CDDIS has experienced over the past several years, namely, the lack of consistent and redundant power and cooling in its existing computer facility. CDDIS will be utilizing a large storage system to easily accommodate future growth of the archive.

### Applications Development

The average user of the CDDIS accesses the contents of the archive through anonymous ftp by means of automated scripts. Analysts can use this method for data transfer because they are familiar with the structure of the CDDIS and thus know what files they require, their availability schedule, and where to find them within the online structure. However, new users of the CDDIS, both those familiar with space geodesy techniques as well as new research communities, may prefer a browsing interface to the archive contents. Therefore, the CDDIS has undertaken the design of a web interface based search tool that queries the CDDIS metadata. This process has required limited modification of the database schemas to reflect changes to the metadata. Users will have the ability to specify search criteria based on temporal, spatial, target, site designation,

and/or observation parameter in order to identify data and products of interest for download. Results of these queries will include a listing of sites (or other metadata) or data holdings satisfying the user input specifications. Such a user interface will also aid CDDIS staff in managing the contents of the archive.

**More Information/Feedback:**

The staff welcomes feedback on the CDDIS and in particular the ideas expressed in the poster and paper; users are encouraged to contact the authors to provide feedback or obtain additional information about the CDDIS. The data and products are acquired as part of NASA's Earth Science Data Systems and archived and distributed by the Crustal Dynamics Data Information System (CDDIS):

C. Noll, The Crustal Dynamics Data Information System: A resource to support scientific analysis using space geodesy, *Advances in Space Research*, Volume 45, Issue 12, 15 June 2010, Pages 1421-1440, ISSN 0273-1177, DOI: 10.1016/j.asr.2010.01.018.